The LBA Project: Nutrient Cycles and Trace Gas Exchange in the Cerrado of Central Brazil

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The Cerrado of central Brazil is one of the largest savannah regions on earth. The "stressors" affecting ecosystems in this region, including deforestation, fire, soil degradation, unwise agricultural practices, climate change, and urbanization, are all experienced in many U. S. ecosystems. Intense agricultural activities, such as land clearing for soybean cultivation and cattle farming, are rapidly changing the Cerrado. U.S. Environmental Protection Agency (U.S. EPA) scientists have been collaborating with ecologists from the Universidade de Brasília (UnB) in central Brazil to determine how several of these stressors are affecting soil nutrient cycling, decomposition, and the soil–atmosphere exchange of carbon- and nitrogen-containing trace gases. The research is contributing data and scientific understanding for the development of models that describe these stressor–ecosystem interactions. Such models play an important role in the U.S. EPA's development of ecosystem protection and remediation strategies. The team of U.S. EPA and UnB scientists is part of the Large Scale Biosphere–Atmosphere Experiment in Amazonia (LBA). The LBA project was created through an international cooperative agreement and includes participants from Brazil, other Amazonian countries, the U.S., and European nations. The LBA participants have conducted research at locations distributed throughout the Amazonian rain forest, the Cerrado, and atmosphere. U.S. EPA/UnB researchers have focused on the effects of fire and land use change on (1) the composition and persistence of litter and soil organic carbon and nitrogen cycling, (2) soil–atmosphere fluxes of gases that have greenhouse warming potential (carbon dioxide, nitrous oxide) and that affect air quality (carbon monoxide, nitric oxide), and (3) changes in soil microbial community structure. Some of the major results to date indicate that (1) wetting produces intense, short-lived pulses of nitric oxide emissions from dry Cerrado soils, (2) soil carbon dioxide emissions correlate with soil moisture levels, (3) decomposition of nonliving plant matter at the soil surface is a significant carbon monoxide source, and (4) soil microbial community structure and size are significantly affected by fertilization practices, burning regime, and land use. The research has led to development of effective interactions between Brazilian and U.S. EPA scientists that provide a springboard for the initiation of actions that protect and remediate the environment in both countries.